Section A

Q.No.	(a)	(b)	(c)	(d)	Q.No.	(a)	(b)	(c)	(d)
1				X	16	X			
2		X			17				X
3				X	18	X			
4			X		19		X		
5			X		20	X			
6	X				21		X		
7			X		22		X		
8				X	23		X		
9		X			24				X
10	X				25			X	
11		X			26		X		
12			X		27				X
13			X		28				X
14	X				29	X			
15			X		30			X	

SECTION B (Long questions)

Ans 31.

The question is based on a 'Scientific Skills Exercise' given in Biology a global approach 10th Edition Campbell et al. (Pearson publication).

		Budding cell	Mature cell
	Diameter (μm)	2	4
Ans. i.	Volume (μm^3)	4	32
Ans. ii.	Surface area (μm^2)	12	48
Ans iii.	SA/Volume	3	3/2

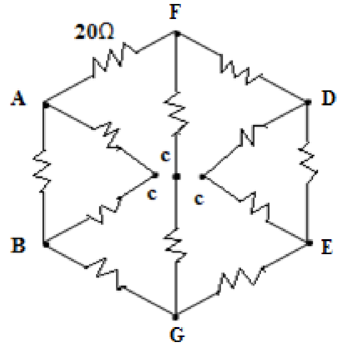
iv.

a) less
b) greater
c) a high ratio of surface area to volume
d) intestinal

v. Nine smaller cells

Ans 32a.

Using the hint given in the question, equivalent circuit can be drawn as given below.



$R_{DE} = 40/3\ \Omega$, $R_{FDEG} = 160/3\ \Omega$,

$R_{FG} = 160/7\ \Omega$, $R_{AFGB} = 440/7\ \Omega$,

$R_{AB} = 11\ \Omega$.

Ans 32b.

Conversion into ammeter always decreases the sensitivity as more current gives the same deflection, while voltage sensitivity is unaffected as there is same voltage across galvanometer and its shunt, i.e., across the ammeter.

$I_g = 100\ \mu A,\ \ V_g = 5\ V \quad \therefore G = 50\ \Omega$

Shunt deviates 80% of total current.

$\therefore I_s = 4I_g \therefore S = \frac{G}{4} = 12.5\ \Omega \therefore Resistance\ of\ ammeter = 10\ \Omega$

(Correct) current passing through the bulb, I = 6/40 = 0.15 A
Current actually passing through the bulb after connecting the ammeter,
I' = 6/50 = 0.12 A

$$\therefore \Delta I = 0.03\ A \therefore \frac{\Delta I}{I} = \frac{0.03}{0.15} = 0.2 = 20\ \%$$

Ans 33a.

Mol. wt of SnO_2 = 151 g/mol

% of Sn = (119/ 151) x 100 = 78.8 % Sn in SnO_2

1.27 x (78.8/100) = 1 g of Sn in sample

Mol. wt. of $PbSO_4$ = 303 g/mol

% of Pb = (207/303) x 100 = 68.3 % of Pb in $PbSO_4$

2.93X (68.3/100) = 2 g of Pb in sample

(2/3) x 100 = 66.7 % of Pb (1/3) x100 = 33.3 % of Sn

Ans 33 b.

a. HIn $\rightleftarrows$ H+ + In-

b. KIn = [H+] [In-]/ [HIn]

c. At eq. point,
[HIn] = [In-]
Substituting in b we get,
pKIn = pH

d. KIn = 10^{-9}
pKIn = 9 = pH

Ans 34.

a) G / F
b) F, L, H
c) G
d) K / M
e) K, L

a(i) Ans Curve B

Explanation The canopy keeps sunlight from reaching the plants in the understory. Hence filtered light reaches the plant. Due to this the photosynthetically active radiation (PAR)reaching the leaves of the plants is less as compared to leaves of plant in the canopy. Hence the plants in the understory carry out photosynthesis at a slower rate when compared to plants of the canopy.

bi) False
Explanation: The photo synthesis rate at low irradiance level can be determined by drawing a tangent t o the curve(at low irradiance) the slope of the tangent determines the rate . It is more for curve B. The plants in the understory are shade loving plant and it is seen that they have more chlorophyll content per grana than the plants of the canopy. Hence they are activated at low irradiance level.

bii) True
Explanation: The plants in the canopy receive more sunlight (i.e. PAR reaching them is more) when compared to that reaching the plants of the understory. Hence the overall rate of photosynthesis is high.

Ans 35a.

The volume of the glass piece is 128π cm^3.

The total volume of the water + glass piece is 864π cm^3.

The height of the water level from the bottom is $864\pi / 36\pi = 24$ cm.

The depth of water above the glass piece is 24 - 8 = 16 cm.

The total apparent shift of the bottom is

$$h_1\left(1-\frac{1}{\mu_w}\right)+h_2\left(1-\frac{1}{\mu_g}\right)=16\left(1-\frac{3}{4}\right)+8\left(1-\frac{2}{3}\right)=\frac{20}{3}\text{ cm}$$

Ans 35b.

The sun may be assumed to be at infinity, so the image is formed 5cm behind the diverging lens. The image distance, v is given by $1/(-5) + 1/v = 1/(-10)$ $\therefore$ $v = 10$ cm.
The lateral magnification is 2, so the size of the final image is (0.5) x 2 = 1 cm

Ans 36.

a. $H_2S \rightleftharpoons 2H^+ + S2^-$

b. $H_2S \rightleftharpoons 2H^+ + S2^-$

$0.1 \qquad 0 \qquad 0$

$0.1- x \qquad 2x \qquad x$

$$\frac{0.1-x}{1.6} \qquad \frac{2x}{1.6} \qquad \frac{x}{1.6}$$

$$K = \frac{[\frac{2x}{1.6}]^2 \quad [\frac{x}{1.6}]}{\frac{0.1-x}{1.6}}$$

$$\frac{4x^3}{2.56 \text{ x } 0.1} = 1 \text{ x } 10^{-6}$$

$4x^3 = 256 \text{ x } 10^{-9}$

$x^3 = 64 \text{ x } 10^{-9}$

$\mathbf{x = 4 \text{ x } 10^{-3}}$

$\%x = 4 \text{ x } 10^{-3} \text{ x } 10^2$

$= 4 \text{ x } 10^{-1}$

= 0.4 %

Ans 37. Duodenum/small intestine (as the salivary amylase in inactivated due to acidity of stomach)

i. Duodenum/small intestine (as the salivary amylase is inactivated due to acidity of stomach)

ii. Duodenum/small intestine (as it is the 1st site to receive bile juice which starts emulsification)

iii. ‘C’ as salivary amylase is inactivated due to stomach acidity.

iv. Sodium phosphate buffer pH 6.8

v. 300 ml of 10% glucose contains 30 g glucose = 1/6 mole

Out of that the absorption efficiency is 10%

So the absorbed glucose will be 1/60 mole

1 mole contains $6\text{x}10^{23}$ molecule glucose that generates $36\text{x}6\text{x}10^{23}$ molecules of ATP

So 1/60 mole glucose generates $3.6\text{x}10^{23}$ molecules of ATP

Ans 38a

Let 'a' be the upward acceleration of the system when the sphere is about to detach.

(The contact force (reaction force, not magnetic force) between sphere and magnet just becomes zero at this acceleration).

Force equation for the sphere (with zero contact force) is

$0.5a = 20 - 0.5g - 0$

$\therefore a = 15 \text{ m/s}^2$

For the magnet, (with zero contact force),

$0.2a = T - 0.2g - 20 + 0$

$\therefore T = 28$ N.

Ans 38b.

At terminal (constant) velocity,

mg = air resistance = kv_T *and* $K.E. = \frac{1}{2} mv_T^2$

$\therefore v_T = \sqrt{500}$ *and* $k = \sqrt{80}$

Ans 39.

Let x be the mass of $H_2C_2O_4$ in the mixture, then (2.02 –x) is the mass of $NaHC_2O_4$

Amount of $H_2C_2O_4$ = x/ $90 gmol^{-1}$

Amount of $NaHC_2O_4$ = (2.02 – x)/$112 gmol^{-1}$

The mixture is dissolved to make 1 liter of solution

Hence molarity of H2C2O4 = (x/90 g) molL-^{1}

Molarity of $NaHC_2O_4$ = ((2.02 – x) / 112g) molL-^{1}

Reaction, $H_2C_2O4 + 2\ NaOH = Na_2C_2O4 + 2H_2O$

$NaHC_2O_4 + NaOH = Na_2C_2O_4 + H_2O$

Hence, 1 mol $H_2C_2O_4$ = 2eq H_2C_2O4

1 mol $NaHC_2O_4$ = 1eq $NaHC_2O_4$

Normality of $H_2C_2O_4$ = (x/90)(2) = (x/45)

Normality of $NaHC_2O_4$ = (2.02 – x/112) (1)

Total Normality of the solution

$N_{Total} = [(x/45) + (2.02 – x/112)]$

Since 10 ml of the solution is titrated, hence the amount (in equivalent) of the mixture in 10ml of the solution will be

$10 /1000 [(x/45) + (2.02 – x/112)] = 10^{-2} [(x/45) + (2.02 – x/112)]$ eq……… 1

Since 3ml of 0.1N NaOH is consumed, the amount (in equivalent) of the mixture will be $3 \text{ ml} / 1000 (0.1) = 3 \times 10^{-4}$ eq ……….2

Equating 1 and 2 we get

$3 \times 10^{-4} = 10^{-2} [(x/45) + (2.02 – x /112)]$

Solving x we get, x = 0.9g (Oxalic acid)

$2.02 – x = 2.02 - 0.9$

$= 1.12$ g ($NaHC_2O_4$)

Ans 40.

i) nucleic acid-- amino acid- -chlorophyll

Simpler compounds were formed earlier and complex biomolecules later

ii) Hydrogen and Methane

Primitive earth had reducing environment.

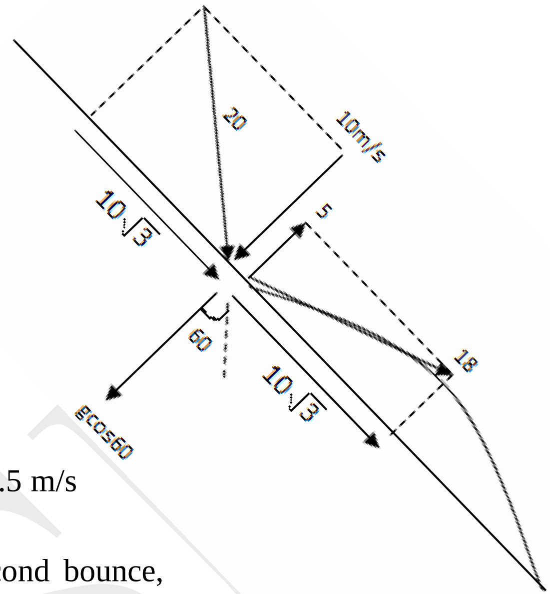
iii) UV rays and lightening energy

High energy was required for formation of biomolecules.

(iv)

a) school one
b) school two
c) school one
d) school two

Ans 41a.



Striking speed at first impact = 6 m/s. Its component along the plane ($3\sqrt{3}$ m/s) is unchanged. The component normal to the plane (3 m/s) decreases due to partially inelastic collision (e = 0.5) and becomes 1.5 m/s.

Thus the ball bounces with normal component 1.5 m/s and 'along plane' component $3\sqrt{3}$ m/s.

Method I: For projectile between first and second bounce, time of flight, $T = \frac{2u\sin\theta}{g'}$ = 0.6 second

where u is the bouncing speed ($u\sin\,\theta$ = normal component = 1.5 m/s)

g' = normal component of $g = g\cos\theta = g\cos 60^0 = 5\ m/s^2$

Method II: At the instant of second bounce, displacement normal to the plane is zero. Effective g' (normal to the plane) is $g\cos 60^0 = 5$ m/s^2. Initial normal velocity (for second bounce) = 1.5 m/s

$\therefore 0 = 1.5T - \frac{1}{2} g' T^2 \therefore T = 0.6\ s$

Ans 41b.

Loss in the gravitational potential energy of the system = (0.5 – 0.3)g = 2 J.

Equating the gain in kinetic energy of the system to the loss of gravitational P. E., the velocity v of the system is given by

$1/2(0.3 + 0.5)v^2 = (0.5 - 0.3)g$

$\therefore v^2 = g/2 = 5$

At this instant, the mass of 400 g is removed from the system. This reduces the K. E. of the system by ½(0.4)5 = 1 J.

The distance ascended by the 300 g mass (after this) should be such that the K. E. of the system is reduced to zero at the uppermost position of 300 g mass.

Hence, $(0.3 - 0.1).g.h = 1$

$\therefore h = 1/2$ m

Ans 42.

Reaction : (ia) $KBrO_3 + 5KBr + 3H_2SO_4 \longrightarrow 3K_2SO_4 + 3H_2O + 3Br_2$

(ib) $2KI + Br_2 \longrightarrow 2KBr + I_2$

(ic) $I_2 + 2Na_2S_2O_3 \longrightarrow 2NaI + Na_2S_4O_6$

i. Molar proportion $KBrO_3 : KBr = 1:5$

ii. $1[KBrO_3] = 3[Br_2] = 3[I_2] = 6[Na_2S_2O_3]$
10ml of 0.01M $KBrO_3$ = 0.1M mol $KBrO_3$ = 0.6M mol $Na_2S_2O_3$
Therefore, 12ml of 0.05M $Na_2S_2O_3$ are required.